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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Norio FUKUSAWA et al.** PATENT APPLICATION

Serial Number: **(Divisional of Appln. Serial No. 09/029,608, filed March 15, 1998)** Prior Art Unit: **2814**

Filed: Herewith Prior Examiner: **D. Graybill**

For: **METHOD AND MOLD FOR MANUFACTURING SEMICONDUCTOR DEVICE, SEMICONDUCTOR DEVICE, AND METHOD FOR MOUNTING THE DEVICE**

#3/a
1-18-01
Payton

PRELIMINARY AMENDMENT

Director of Patents and Trademarks
Washington, D.C. 20231

Date: August 8, 2000

Sir:

Prior to continued examination on the merits, please amend the above-identified application as follows:

IN THE CLAIMS:

Please cancel claims 13-19, 36, 41-43, 54-64, 70-77 and 79-85 without prejudice or disclaimer.

Please amend claims 1-12, 20-35, 37-40, 45-53, 65-69, 78 and 86 as follows:

Claim 1, line 2, delete "characterized by";

line 5, after "formed", insert --to a mold--.

Claim 2, line 3, change "characterized in that" to --wherein--.

Claim 3, line 2, delete "or 2";

line 3, change "characterized in that" to --wherein--.

4. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 3] claim 1, [characterized in that] wherein:

the mold used in the resin sealing step comprises an upper mold which can be elevated, and a lower mold having a first lower mold half body which is kept stationary and a second lower mold half body which can be elevated with respect to the first lower mold half body; and

the resin sealing step comprises:

a substrate loading step of placing the substrate on which the semiconductor elements having the protruding electrodes are arranged in a cavity defined by a cooperation of the first and second lower mold half bodies and providing the sealing resin in the cavity;

a resin layer forming step of moving down the upper mold and the second lower mold half body so that the sealing resin is heated, melted and compressed so that the resin layer sealing the protruding electrodes is formed; and

a detaching step of moving up the first mold so as to detach the upper mold from the resin layer, and then moving down the second lower mold half body from the first lower mold half body so that the substrate to which the resin layer is provided is detached from the mold.

5. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 4] claim 1, [characterized in that] wherein:

an excess resin removing mechanism is provided in the mold used in the resin sealing step; and

the excess resin removing mechanism removes excess resin and controls a pressure applied to the sealing resin in the mold.

6. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 5] claim 3, [characterized in that] wherein the resin sealing step uses

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a sheet-shaped resin as the sealing resin.

7. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 3 to 6] claim 3, [characterized in that] wherein the sealing resin is provided to the film before the resin sealing step is executed.

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8. (Amended) The method for fabricating the semiconductor device as claimed in claim 7, [characterized in that] wherein a plurality of sealing resins are provided to the film, and the resin sealing step is continuously carried out [while the film is moved] by moving of the film.

9. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 through 8] claim 1, [characterized in that] wherein a reinforcement plate is loaded onto the mold before the substrate is loaded onto the mold in the resin sealing step.

Claim 10, line 3, change "characterized in that" to --wherein--.

11. (Amended) The method for fabricating the semiconductor device as claimed in [claims 1 to 10] claim 1, [characterized in that] wherein the protruding electrode exposing step uses means for exposing the ends thereof from the resin layer, said means being at least one of a laser beam projection, eximer laser, etching, mechanical polishing, and blasting.

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12. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 3 through 10] claim 3, [characterized in that] wherein:

the film used in the resin sealing step is formed of an elastically deformable substance, and the ends of the protruding electrodes are caused to fall in the film when the resin layer is formed by using the mold; and

the film is detached from the resin layer in the protruding electrode exposing step so that the ends of the protruding electrodes can be exposed from the resin layer.

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20. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 12] claim 1, [characterized in that] wherein the sealing resin used in the resin sealing step comprises a plurality of sealing resins having different characteristics.

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21. (Amended) The method for fabricating the semiconductor device as claimed in claim 9 [or 10], [characterized in that there is provided] further comprising a reinforcement plate to which the sealing resin is provided beforehand in the resin sealing step.

Claim 22, line 3, change "characterized in that" to --wherein--.

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23. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 12] claim 1, [characterized in that] wherein a second resin layer is formed so as to cover a back surface of the substrate after or at the same time as the first, resin layer is formed, in the resin sealing step, on the surface of the substrate on which the protruding electrodes are arranged.

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24. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 3 to 10] claim 3, [characterized in that] wherein:

the film used in the resin sealing step has projections located in positions corresponding to those of the protruding electrodes; and

the resin layer is formed in a state in which the projections are pressed against the protruding electrodes.

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25. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 12 and 20 to 24] claim 1, [characterized in that] wherein:

an external connection protruding electrode forming step is executed which forms external connection protruding electrodes on the ends of the protruding electrodes after the ends of

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the protruding electrodes are exposed from the resin layer in the protruding electrode exposing step.

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~~26.~~ (Amended) The method for fabricating the semiconductor device as claimed in
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claim ~~25~~, [characterized in that] wherein the protruding electrodes and the external connection protruding electrodes are bonded by using a bonding member having a characteristic of stress relaxation in the external connection protruding electrode forming step.

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~~27.~~ (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 12 and 20 to 26] claim 1, [characterized in that] wherein:

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cutting position grooves are formed, before the resin sealing step is carried out, in the substrate so as to be located in positions in which the substrate is cut in the separating step; and

the substrate is cut in the cutting position grooves filled with the sealing resin.

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~~28.~~ (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 12 and 20 to 26] claim 1, [characterized in that] wherein:

a pair of stress relaxing grooves is formed, prior to the resin sealing step, so as to sandwich a position in which the substrate is to be cut; and

the substrate is cut in the position interposed between the pair of stress relaxing grooves in the separating step.

Claim 29, line 2, delete "characterized by".

Claim 30, line 2, delete "characterized by".

Claim 31, line 3, change "characterized in that" to --wherein--;

line 4, change "owned" to --included--.

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~~32.~~ (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 12 and 20 to 31] claim 1 or ~~30~~ 23, [characterized in that] wherein

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a5 positioning grooves are formed on a back surface of the resin layer [or] of the substrate after the resin

Cont'd sealing step is executed and before the separating step is executed.

Claim 33, line 3, change "characterized in that" to --wherein--.

~~34.~~ 27 (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 3 to 12 and 20 to 29] claim 3, [characterized in that] wherein:

the film used in the resin sealing step has projection or recess portions located in positions in which the film is not interfered with the projecting electrodes; and

a6 recess or projection portions formed on the resin layer by the projection or recess portions are used for positioning after the resin sealing step is completed.

~~35.~~ 28 (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 1 to 12 and 20 to 29] claim 1, [characterized in that] wherein the sealing resin is processed in positions in which positioning protruding electrodes are formed in order to discriminate the protruding electrodes and the positioning protruding electrodes from each other.

~~37.~~ 29 (Amended) [The] A method for mounting [the] a semiconductor device [as claimed in claim 36], comprising mounting the semiconductor device [characterized in that the semiconductor device is mounted] on a mounting board so as to vertically stand thereon, the semiconductor device comprising:

a7 a semiconductor element having a surface on which external connection electrodes are provided which are to be electrically connected to external terminals; and

a resin layer provided on the surface of the semiconductor element so as to cover the external connection electrodes,

wherein the external connection electrodes are exposed at a lateral surface of the resin layer.

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Claim 38, line 3, change "characterized in that" to --wherein--.

Claim 39, line 3, change "characterized in that" to --wherein--.

~~40~~ 32. (Amended) The method for mounting the semiconductor device as claimed in [any of claim 18, 19 and 36] claim ~~18 or 36~~ 29, [characterized in that] wherein the semiconductor device [is mounted on a mounting board through] has an interposer having an outer connection means, and wherein an interval between the outer connection means is wider than an interval between the protruding electrodes.

Claim 45, line 3, change "characterized in that" to --wherein--.

Claim 46, line 2, delete "or 45";

line 3, change "characterized in that" to --wherein--.

Claim 47, line 2, delete "or 45";

line 3, change "characterized in that" to --wherein--.

Claim 48, line 3, change "characterized in that" to --wherein--.

~~49~~ 38. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 44 to 48] claim ~~44~~ 33, [characterized in that there is provided] wherein an excess resin removing mechanism is provided in the mold used in the resin sealing step,

wherein the excess resin removing mechanism removes excess resin and controls a pressure applied to the sealing resin in the mold.

~~50~~ 39. (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 44 to 49] claim ~~44~~ 33, [characterized in that] wherein:

extending portions are formed to the wiring board so that the extending portions laterally extend from a position in which the semiconductor element is placed; and

a bending step of bending the extending portions is executed after the resin sealing

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step is completed and before the protruding electrode forming step is executed.

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~~51.~~ (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 44 to 49] claim 33, [characterized in that] wherein:

extending portions are formed to the wiring board so that the extending portions laterally extend from a position in which the semiconductor element is placed;

a bending step of bending the extending portions is carried out before the resin sealing step is executed; and

the resin sealing step and the protruding electrode forming step are carried out after the bending step is executed.

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~~52.~~ (Amended) The method for fabricating the semiconductor device as claimed in claim 39 [or 51], [characterized in that] wherein:

connection electrodes to be connected to the semiconductor element are formed to ends of the extending portions; and

an element connecting step of connecting the semiconductor element and the connection electrodes is executed after the bending step is carried out.

Claim 53, line 3, change "characterized in that" to --wherein--.

Claim 65, line 2, delete "characterized by".

Claim 66, line 3, change "characterized in that" to --wherein--.

Claim 67, line 2, delete "or 66";

line 3, change "characterized in that" to --wherein--.

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~~68.~~ (Amended) The method for fabricating the semiconductor device as claimed in [any of claims 65 to 67] claim 43, [characterized in that] wherein:

a chip attachment step of positioning the semiconductor elements on the heat

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radiating member and attaching the semiconductor elements thereto before the chip mounting step is executed; and

the semiconductor elements attached to the heat radiating member are mounted to the electrode plate in the chip mounting step.

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~~69.~~ (Amended) The method for fabricating the semiconductor device as claimed in claim ~~65~~ 43 [or 68], [characterized in that] wherein:

protruding terminals protruding from the electrode plate are formed in the electrode plate forming step; and

the sealing resin is formed, in the sealing resin forming step, so as to expose the protruding terminals from the sealing resin.

Claim 78, line 2, delete "characterized by".

Claim 86, line 2, delete "characterized by".

Please add new claims 87-90 as follows:

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--~~87.~~ A method for fabricating the semiconductor as claimed in claim 1, wherein the resin sealing step disposes a film between the substrate and the mold.

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~~88.~~ A method for fabricating the semiconductor as claimed in claim 4, wherein the resin sealing step further comprises a film disposing step of providing a non-adhesive process film between contact surfaces of the upper mold and the first lower mold half body and the second mold half body.

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~~89.~~ A method for fabricating a semiconductor device, comprising the steps of:

an encapsulating step of supplying a rigid sealing material to a substrate on which protruding electrodes are formed so as to form an encapsulation layer which seals the protruding electrodes and the substrate;

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a stiffening step of heating the encapsulation layer;

a protruding electrode exposing step of exposing at least ends of the protruding electrodes from the resin layer; and

a separating step of cutting the substrate together with the resin layer so that the semiconductor elements are separated from each other.

All Cont'd

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~~90.~~ A method for fabricating a semiconductor device comprising:

a mold preparing step of preparing a mold including a first mold, and a second mold which is located so as to face the first mold, the second mold including a first half body having a shape corresponding to a shape of a substrate, and a second half body which is provided so as to surround the first half body and can be elevated with respect to the first half body, the first and second half bodies cooperating with each other so that a cavity to be filled with resin is defined;

a resin sealing step of placing the substrate on which a plurality of semiconductor elements equipped with protruding electrodes are formed in the mold and supplying resin to positions in which the protruding electrodes are provided so as to form a resin layer which seals the protruding electrodes and the substrate.;

a protruding electrode exposing step of exposing at least end portions of the protruding electrodes from the resin layer; and

a separating step of cutting the substrate together with the resin layer so that the semiconductor elements are separated into each other.--

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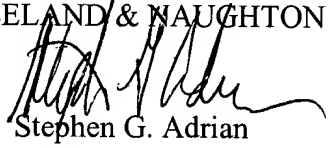
REMARKS

Claims 1-12, 20-35, 37-40, 44-53, 65-69, 78, 86-90 are pending. The above-amendments are made to place the application in better condition for examination. Prompt and favorable action on the merits is earnestly solicited.

In the event that any fees are due in connection with this paper, please charge our Deposit Account No. 01-2340.

Respectfully submitted,

ARMSTRONG, WESTERMAN, HATTORI,
McLELAND & NAUGHTON



Stephen G. Adrian
Attorney for Applicants
Reg. No. 32,878

Atty. Docket No. 980233A
1725 K Street, N.W., Suite 1000
Washington, DC 20006
Tel: (202) 659-2930
Fax: (202) 887-0357
SGA/arf